NASAfacts

Flight Opportunities Program Overview

NASA's Flight Opportunities program strives to advance the operational readiness of innovative space technologies while also stimulating the growth of the U.S. commercial spaceflight industry. Flight Opportunities is part of NASA's Space Technology Mission Directorate (STMD).

The Flight Opportunities program provides access to space-relevant environments through the use of commercial reusable suborbital launch vehicles (sRLVs), rocket powered Vertical Take-off Vertical Landing (VTVL) platforms, high-altitude balloons and parabolic aircraft flights. These platforms bridge the critical gap between laboratory or ground-based testing and demonstration of technical readiness in a mission-relevant, operational environment.

Since its initiation in 2010, the Flight Opportunities program has provided affordable access to relevant test environments for over 100 payloads across a variety of flight platforms.

Payload Selection and Flights
The program facilitates technology development payloads from many sources, including NASA, other government agencies, academia, industry and international partners. Proposals are assessed according to:

1. Relevance to U.S. space exploration and utilization goals
2. Technical approach
3. Cost, value and schedule

Commercial vehicles will provide flights for NASA-selected proposals to be funded by the agency's Flight Opportunities Program.

There are currently two paths for accessing flight opportunities:

Space Technology Research, Development, Demonstration, and Infusion (SpaceTech-REDDI) NASA Research Announcement (NRA)

Non-U.S. government researchers can compete for flight funding through the SpaceTech-REDDI NRA. Selected projects receive awards enabling the researcher to purchase flights directly from any qualified U.S. suborbital flight vendors that best meet the needs of the project.

NASA Internal Calls for Payloads
This path facilitates suborbital flight demonstrations of technology payloads by NASA and other U.S. government principal investigators. A selection of commercial suborbital vendors provides payload flights through NASA Indefinite Delivery Indefinite Quantity (IDIQ) contracts.

Flight Platforms
Four types of flight platforms are currently used for flight demonstrations:

- **Rocket-powered Vertical Take-off Vertical Landing (VTVL) Platforms:** Low-altitude descent and landing enables testing of novel algorithms and sensors for final descent and landing on planetary bodies in the solar system.
- **Suborbital Reusable Launch Vehicles (sRLVs):** sRLVs allow the testing and validation of new technologies in microgravity. Flights typically provide three to four minutes of microgravity.
- **High-altitude Balloons:** Balloons facilitate the testing of technologies under extended exposure to space-like conditions such as low temperature or radiation. Balloons also offer the ability to perform drop tests from high altitude.
- **Parabolic Flights:** Parabolic aircraft flights enable investigation of repeated exposure to reduced gravity, approximately 15 to 20 seconds per parabola, with typical missions flying approximately 30 to 40 parabolas during one flight.

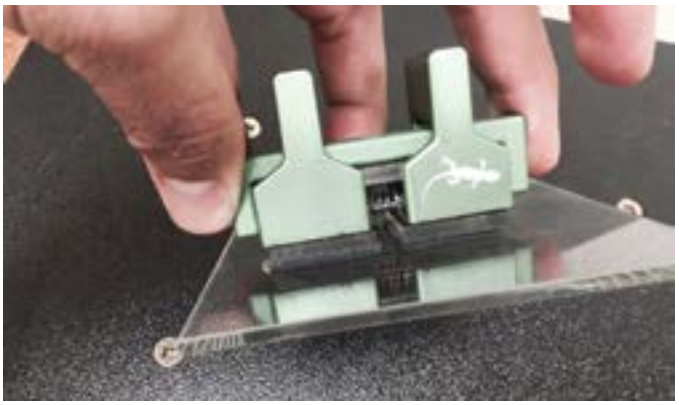
Technology Successes
The Flight Opportunities program has seen the successful evolution of many technologies as research on various payloads advances technology readiness levels and pushes these innovations to the next stage of development. Examples include:

Space manufacturing with 3D printing
Made In Space, Inc. is using additive manufacturing, or 3-D printing, to make space-based manufacturing a reality. Initial parabolic flights of a customized 3-D printer designed for use in

microgravity were conducted in the summer of 2011. The technology has since been matured via additional flights that led to its acceptance for further testing on the International Space Station (ISS). The company's new Additive Manufacturing Facility (AMF), featuring a wide range of polymers, was launched to the ISS in March 2016.

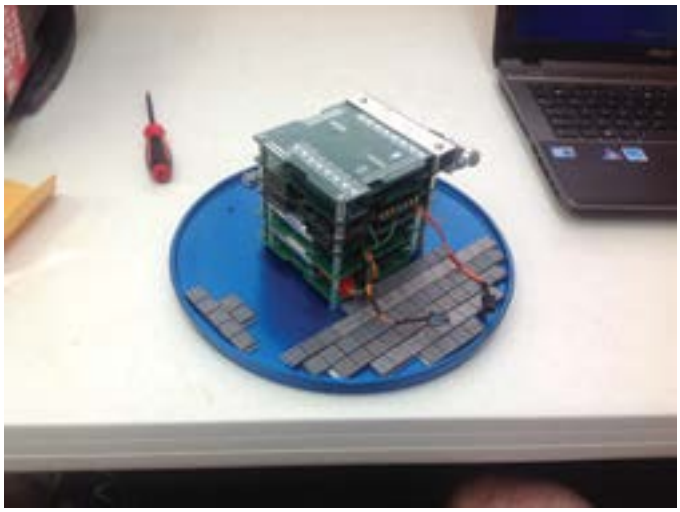
Made in Space, Inc., Moffett Field, California, has designed a 3-D printing experiment to help develop additive manufacturing capabilities for microgravity. Manufacturing parts in space on-orbit could reduce operational cost and improve en route repair capabilities for long duration human exploration missions.

Getting a handle on objects with Gecko Grippers
Using switchable adhesives, researchers at NASA's Jet Propulsion Laboratory (JPL) have developed a new technology for grappling small floating objects in microgravity. These Gecko Grippers, which also headed to the ISS for further investigation in March 2016, use a gecko-like adhesive that can stick on command in harsh space environments, opening up new capabilities such as robotic crawlers for walking along spacecraft exteriors, grippers for catching and releasing objects, and reusable sensor mounts.



The JPL-designed Gecko Gripper, which can adhere objects to virtually any surface, was tested in the Flight Opportunities program in 2014 and 2015. (NASA/JPL-Caltech image)

Improving radiation tolerant computing with RadSat
Developed at Montana State University in collaboration with NASA's Goddard Space Flight Center, the new Radiation Tolerant SmallSat Computer System ("RadSat") promises increased performance, power efficiency, and radiation tolerance at a fraction of the cost of existing radiation hardened computing solutions—all using a commercially available Field Programmable Gate Array (FPGA). With a steady increase in TRL over the last eight years, the technology has been selected for a sounding rocket flight in 2016 and is also part of the NASA Experimental Program to Stimulate Competitive Research, including a six-month demonstration on the ISS. In addition, the 2015 CubeSat Launch Initiative selected the technology for an orbital flight demonstration through the NASA Educational Launch of Nanosats program; RadSat will be integrated into a 3U CubeSat in preparation for launch in the 2016-17 timeframe.



Montana State and NASA Goddard collaboration to develop a radiation-tolerant reconfigurable computer system expected to deliver increased computing performance at both lower power and cost. (Montana State image)

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